U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Trifolium friscanum

Common Name:

Frisco clover

Lead region:

Region 6 (Mountain-Prairie Region)

Information current as of:

05/03/2016

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

- ___ Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status
- ___ Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species
- ___ Range is no longer a U.S. territory
- ___ Taxon mistakenly included in past notice of review

___ Taxon does not meet the definition of "species"

___ Taxon believed to be extinct

___ Conservation efforts have removed or reduced threats

___ More abundant than believed, diminished threats, or threats eliminated.

___ Insufficient information exists on taxonomy, or biological vulnerability and threats, to support listing

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 07/30/2007

90-Day Positive:08/18/2009

12 Month Positive:02/23/2011

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The ï¿½Progress on Revising the Listsï¿½ section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Utah
- **US Counties**: Beaver, UT, Millard, UT
- **Countries**: United States

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Utah
- **US Counties**: Beaver, UT, Millard, UT
- **Countries**: United States

Land Ownership:

Trifolium friscanum (Frisco clover) is a narrow endemic known from five small populations on private (68 percent of the known individuals), State of Utah School and Institutional Trust Lands Administration (SITLA) (2 percent of the known individuals), Bureau of Land Management (BLM) (13 percent of the known individuals), and U.S. Forest Service (USFS) (16 percent of the known individuals) lands.

Lead Region Contact:

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Biological Information

Species Description:

Trifolium friscanum (Frisco clover) is a dwarf mat-forming or tufted perennial herb in the legume family (Fabaceae). For the purposes of this document, we will refer to *Trifolium friscanum* as “Frisco clover.” Frisco clover plants have a taproot and thick woody stem. Frisco clover is up to 1.2 inches (3 centimeters) tall and has silver hairy leaves composed of three leaflets (Welsh *et a*l. 2008, p. 486). Its flowers resemble those of other clover species and are arranged in heads of four to nine reddish-purple flowers with pale wings (Figure 1; Welsh *et al.* 2008, p. 486).

Figure 1. Frisco clover plant. Photo: D. Roth, USFWS

Taxonomy:

Frisco clover was originally described by Stanley Welsh as *T. andersonii* var. *friscanum* from specimens collected on Grampian Hill in the southern San Francisco Mountains in Beaver County, Utah (Welsh 1978, p. 355). The variety was elevated to species level in 1993 (Welsh 1993, p. 407). We accept the current taxonomy and consider Frisco clover to be a valid species and a listable entity under the Endangered Species Act (ESA).

Habitat/Life History:

Frisco clover is a narrow endemic restricted to soils derived from volcanic gravels, Ordovician limestone, and dolomite outcrops. Soils are shallow, with gravels, rocks, and boulders on the surface (Kass 1992, p. 3; Miller 2010a, p. 1).

In the southern San Francisco Mountains, where the majority of plants are located, there are 845 acres (ac) (342 hectares (ha)) of Ordovician limestone and 719 ac (291 ha) of dolomite outcrops (Darnall *et al*. 2010, entire). Ordovician limestone is rare within a 50-mile (mi) (80-kilometer (km)) radius of the San Francisco Mountains, but dolomite outcrops are common in the Wah Wah

Mountain Range to the west (Miller 2010b, Appendix F). We have no information on the extent of volcanic gravels in the area. We do not know if there are other limiting factors associated with the limestone and dolomite formations that restrict the habitat use and distribution of the species; the species occupies only a fraction of the available habitat. The two largest populations— Grampian Hill and San Francisco—occupy an estimated 35 ac (14 ha) (2.3 percent) of the available limestone and dolomite outcrops (Darnall *et al.* 2010, entire). We do not have occupied habitat area totals for the remaining four populations, but we believe they are smaller, based on field evaluations and the lower number of individuals in these populations (Kass 1992, p. 3; Miller 2010a, p. 1; Roth 2010, pp. 1–2).

Frisco clover is typically found within sparsely vegetated pinion-juniper-sagebrush communities between 5,640 and 8,440 feet (1,720–2,573 meters) in elevation.

Associated species include *Ephedra* spp. (Mormon tea), *Gutierrezia sarothrae* (snakeweed), *Cercocarpus intricatus* (dwarf mountain-mahogany), and *Petradoria pumila* (rock goldenrod). Associated rare species in the southern San Francisco Mountains include *Eriogonum soredium* (Frisco buckwheat) and *Lepidium ostleri* (Ostler's peppergrass), which generally grow on the same substrate in similar but more open habitats adjacent to Frisco clover. Flowering occurs from late May to June, followed by fruit set in June through July (Welsh *et al*. 2008, p. 486). No other information is available on the life history of this species.

Historical Range/Distribution:

Frisco clover is historically and currently (see Current Range/Distribution, below) known from five populations on private, SITLA, BLM, and USFS lands in Beaver and Millard Counties, Utah (Figure 2; Kass 1992, pp. 4–5; Evenden 1998, pp. 6–7, Appendix C; Evenden 1999, pp. 2–3; Miller 2010c, pp. 1, 4; Miller 2010d, pers. comm.; Roth 2010, p. 4).

Current Range Distribution:

Frisco clover is a narrow endemic known from five small populations containing ten sites on private, SITLA, BLM, and USFS lands in Beaver and Millard Counties, Utah (Figure 2; Table 1; Kass 1992, pp. 4–5; Evenden 1998, pp. 6–7, Appendix C; Evenden 1999, pp. 2–3; Miller 2010e, pers. comm.; Miller 2010c, pp. 1, 4; Miller 2010a, p. 1; Miller 2010d, pers. comm.; Roth 2010, p. 4; Hildebrand 2013, pers. comm.). Populations are defined as groups of sites located in the same geographic vicinity. Sites are defined as occurrence records or locations recorded by one or more researchers over time within an individual population. Despite additional searches in the San Francisco Mountains and surrounding areas (including the Confusion Range, the Mountain Home Range, and the Tunnel Springs Mountains), no other populations are known to occur in these areas (Kass 1992, pp. 4–5; Evenden 1998, pp. 6–7, Appendix C; Evenden 1999, pp. 2–3; Miller 2010c, pp. 1, 4; Miller 2010d, pers. comm.; Roth 2010, p. 4; Hildebrand 2013, p. 19). However, a new population of Frisco clover was reported on BLM lands in the Wah Wah Mountains in 2014 and it is currently

awaiting verification (Kitchen 2015, p. 1 – 2); we will provide details regarding this population, if verified, in subsequent species assessments. The new population is estimated to contain 1,000 plants. Additional potential habitat in the Wah Wah Mountains remains unsurveyed.

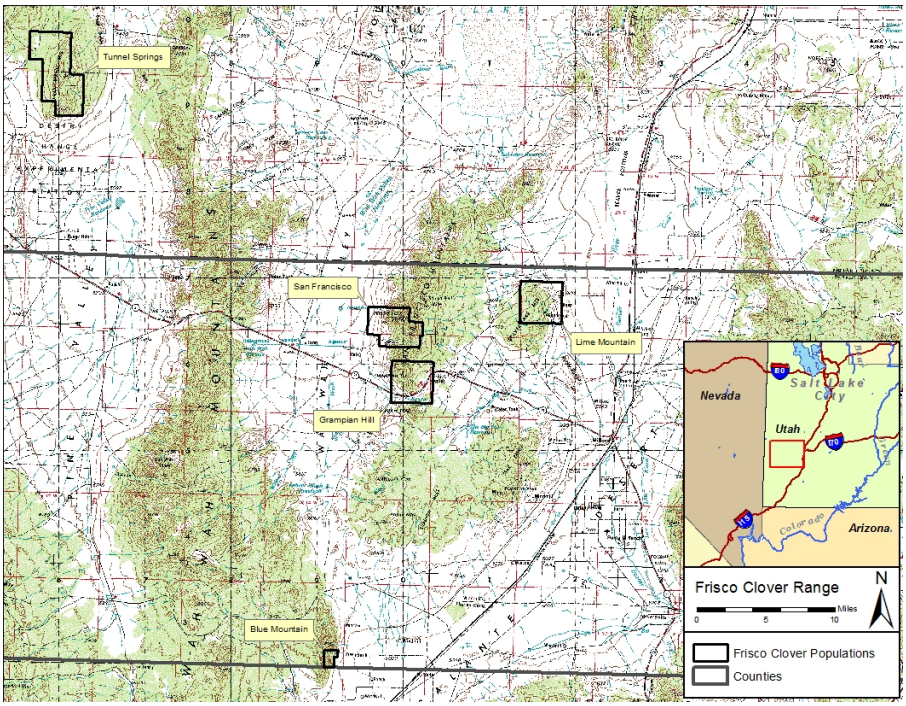


Figure 2. Frisco clover range.

Table 1. Estimated number of Frisco clover plants.

POPULATION	LAND OWNERSHIP/SITES	ESTIMATED # OF PLANTS
Blue Mountain	SITLA (1 site)	250
Grampian Hill	Private (1 site)	5,000*
	BLM (Copper Gulch) (1 site)	1,000
San Francisco	Private (Cactus Mine) (1 site)	300
	Private (Indian Queen) (1 site)	3,000
	BLM (1 site)	at least 125
Lime Mountain	Unknown (1 site)**	at least 500
	BLM (1 site)	500
Tunnel Springs Mountains	USFS (2 sites)***	2,000
ESTIMATED TOTAL		12,675

* There are many thousands of plants at this location, we are assuming 5,000.
** Last surveyed in 1992. All other survey data from 2010 or 2013.

The five populations occur within four mountain ranges in southwestern Utah (Figure 2, Table 1). The two largest populations, the Grampian Hill and San Francisco Populations, occur on the southern tip of the San Francisco Mountains in Beaver County. East of the San Francisco Mountains are the Beaver Lake Mountains, where the Lime Mountain Population occurs on Lime Mountain. West and south of the San Francisco Mountains are the Wah Wah Mountains. Along the southeastern edge of the Wah Wah Mountains is the southernmost population, the Blue Mountain population, which occurs along the Beaver–Iron County boundary line on Blue Mountain. The Tunnel Springs Population occurs in the Tunnel Springs Mountains in Millard County. The Tunnel Springs Mountains are west and north of the Wah Wah Mountains.

Frisco clover populations extend about 40 mi (64 km) from the San Francisco Mountains and stretch across 650 square miles (sq mi)(1,684 square kilometers (sq km))(Figure 2). Within that area, the five populations are scattered in small, disjunct areas of occupied habitat (Figure 2; Table 1).

The majority of plants (71 percent of the estimated populations) are located in the San Francisco and Grampian Hill populations (Miller 2010b, Appendix B). Total occupied habitat for these two populations (four sites) is approximately 35 ac (14 ha)—each site ranges from approximately 1 ac (0.4 ha) to 12 ac (5 ha) in size (Darnall *et al*. 2010, entire). The Blue Mountain population occupies an area of approximately 0.33 ac (0.13 ha) (Darnall *et al*. 2010, entire). We do not have areas of occupied habitat for the Tunnel Springs sites (Tunnel Springs population), or the Lime Mountain population. We assume the area of occupied habitat to be similar to or smaller than the San Francisco, Grampian Hill, and Blue Mountain populations, because the Tunnel Springs and Lime Mountain populations contain fewer or similar numbers of plants as those estimated for the other sites (Table 1).

Population Estimates/Status:

The total number of Frisco clover individuals in Table 1 was derived from observational counts or estimates. The largest population is the Grampian Hill population. The population estimate for the Grampian Hill population was previously described as “many thousands” (Miller 2010e, pers. comm.); for the purpose of this notice of review, we estimate “many thousands” to be approximately 5,000 individuals. Four of the 10 sites are estimated to have 500 or fewer plants (Table 1).

The population estimates were not based on actual counts of plants but on cursory observations with inherent observer biases. Plants grow in dense mat-forming clusters, making it difficult to determine the number of individuals within a cluster. Because individual plants are difficult to distinguish, we do not believe that the variation in population estimates reflects variation in population sizes, but is rather an artifact of survey effort and methods used. Many of the sites occur on private lands where access is restricted, so population counts are estimates.

Accordingly, the available population estimates are highly variable and probably not accurate. During the 1990s, population estimates ranged from 3,500 individuals (Evenden 1998, Appendix C) to approximately 6,000 individuals (Kass 1992, p. 8). In 2010, the total number of plants was

estimated at roughly 12,675 (Table 1; Miller 2010a, p. 1; Miller 2010e, pers. comm.; Miller 2010c, pp. 1, 4; Roth 2010a, p. 4). Because of the uncertainty in the population estimates and the differences in methodologies used to survey the populations, we are unable to make accurate assessments regarding the trend for the species.

Distinct Population Segment(DPS):

Not applicable.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or range:

Our February 23, 2011, 12-month finding (76 FR 10166) evaluated multiple potential threats to Frisco clover under Factor A: livestock grazing, recreational activities, mining, and nonnative invasive species. However, as explained in our 12-month finding, livestock grazing and recreational activities do not currently pose a threat to the species, and we have no new information since 2011 to suggest that these activities would now rise to the level of a threat. Therefore, our discussion below focuses on the primary threats under Factor A affecting the species, including habitat destruction and associated impacts from precious metal and gravel mining on private lands, and the invasion of nonnative species throughout the species' range (see **Nonnative Invasive Species** section below).

Mining

Mining activities that occur throughout Frisco clover's range include mining for precious metals and gravels. Four out of the five known populations of Frisco clover are located at historical precious metal mines or gravel mines, with two of these populations comprising the vast majority (71 percent) of the known estimated population of Frisco clover. As discussed below, we anticipate precious metal mining and gravel mining to continue and expand in three Frisco Clover populations with two of these populations comprising the vast majority (71 percent) of the known estimated population. Mining activities can impact Frisco clover by removing habitat substrate, increasing erosion potential, fragmenting habitat through access road construction, degrading suitable habitat, and increasing invasive plant species (Brock and Green 2003, p. 15; BLM 2008a, pp. 448–449). Impacts to Frisco clover individuals include crushing and removing plants, reducing plant vigor, and reducing reproductive potential through increased dust deposits, reduced seedbank quantity and quality, and decreased pollinator availability and habitat (Brock and Green 2003, p. 15; BLM 2008a, pp. 448–449).

Precious Metal Mining

The San Francisco Mountains have an extensive history of precious metal mining activity (Evenden 1998, p. 3) and historical precious metal mining overlapped with three of the five populations (Table

2). Mining activities at the Lime Mountain population ceased in the 1980s and are not anticipated to restart in the future due to the small amounts of minerals that were found there and extracted (Miller 2010f, p. 6 - 7). Additionally, we have no information that precious metal mining activities have occurred or are planned in the vicinity of the Blue Mountain and Tunnel Springs populations, although future gravel mining is anticipated at Blue Mountain.

Historical precious metal mining-related activities resulted in surface disturbance, increased foot and vehicle traffic, vegetation disturbance, and removal of top soil and overburden. Surface disturbance was extensive and concentrated around the Horn Silver and Cactus Mines due to the high productivity of these mines. As a result, the majority of the 21 acres within these claims were disturbed. Less productive mines resulted in 1 acre or less of disturbance within the 21 acre claim. This footprint includes mine shafts, prospect pits, overburden areas, and roads (Ginouves 2015b). Potential impacts to Frisco buckwheat from these activities include mortality of individuals, localized population mortality, habitat loss, degradation and fragmentation, increased soil erosion, reductions in pollinator populations, reductions in plant vigor and reproductive potential, reductions in seed bank quantity and quality, and increasing invasive plant occurrences (Brock and Green 2003; BLM 2008c). There is also the potential for release or exposure to toxic chemicals and wastes. Similar impacts to Frisco clover would be expected in the future if precious metal mining continues.

We believe that precious metal mining will resume in the future at the locations of the Grampian Hill and San Francisco populations in the southern San Francisco Mountains (Table 2). All precious metal mining claims in the southern San Francisco Mountains are patented (a claim for which the Federal Government has passed its title to the claimant, making it private land) and continued occasional explorations for silver, zinc, and copper deposits are reported for the area (Bon and Gloyn 1998, p. 12; Franconia Minerals Corporation 2002, p. 1). The San Francisco mineral district is the sixth most productive copper mining district in Utah and approximately the eighth largest metal district in Utah (BLM 2012, p. 107).

The likely continuation of precious metal mining within the range of Frisco clover is supported by economic forecasts of an increasing future demand for silver and copper (Crigger 2010, pp. 1–2; Murdoch 2010, pp. 1–2). The price for silver nearly tripled over the last decade (Stoker 2010, p. 2), and the market for silver is expected to grow in the future due to its high demand for industrial uses in solar panel construction, wood preservatives, and medical supplies (Ash 2010, p. 1). Since 2009, the value of copper increased more than 140 percent (Crigger 2010, pp. 1–2; Murdoch 2010, pp. 1–2). The market for copper, one of the world's most widely used industrial metals, is expected to increase in the future due to demand for electrical wiring, plumbing, and car fabrication (Crigger 2010, pp. 1–2; Murdoch 2010, pp. 1–2). In Utah, precious metals accounted for approximately 14 percent of the total value of minerals produced in 2009 (up from 8 percent in 2008) (Utah GOPB 2010, pp. 195–196). Utah's precious metal gross production value increased $221 million (57 percent) compared to 2008, due to increased production of both gold and silver (Utah GOPB 2010, p. 196). Because the San Francisco Mountains area was one of the most productive areas during the last large-scale precious metal mining effort, it is reasonable to assume that it will become important again, particularly given the ongoing exploration activities at the mines.

The Grampian Hill population is located in the area of the King David Mine, which is part of the historical Horn Silver and Cupric mines. The Horn Silver Mine was one of the largest silver mines in the country until it collapsed in 1885 (Murphy 1996, p. 1; Evenden 1998, p. 3). Exploration activities were reinitiated at the Horn Silver Mine in 2002, confirming that extensive amounts of sphalerite (the major ore of zinc) remain in the mine (Franconia Minerals Corporation 2002, p. 1). Therefore, we anticipate precious metal mining to continue and expand in the Grampian Hill population.

The San Francisco population is in the vicinity of mine shafts near the Cactus Mine, an historical copper mine. Although large-scale precious metal mining in the area ceased decades ago, we believe mining is likely to occur again in the foreseeable future due to patent rights and ongoing exploration for silver, zinc, and copper deposits—including recent exploration activities at the Horn Silver Mine (Franconia Minerals Corporation 2002, p. 1). Despite past production from the Cactus mine of approximately 1.27 million tons (1.40 million standard tons) of recovery grade precious metals, the mine is reported to still contain a similar amount of unrecovered mineral resource (BLM 2012, p. 107). Therefore, we anticipate precious metal mining to continue and expand in the area of the Cactus mine and San Francisco population.

Future precious metal mining in the vicinity of the Grampian Hill and San Francisco populations is of concern because these sites comprise the species' largest known populations and contain the vast majority of known individuals (9,300 individuals, or 71 percent of the species' estimated total population) (Table 1).

Table 2. Mining activities in the habitat of Frisco clover.

Population	Historical Activity	Current Activity	Future Activity
Blue Mountain	gravel quarrying (Courgraph Mine)	active	gravel quarrying
Grampian Hill	silver, lead, copper, zinc (Horn Silver Mine), tungsten, fluorite, copper (Cupric Mine)	none	silver, lead, copper, zinc, landscape gravel quarrying
San Francisco	silver, lead, copper, zinc, gravel quarrying (Cactus Mine)	active (gravel quarrying)	silver, lead, copper, zinc, landscape gravel quarrying
Lime Mountain	silver, lead, copper, zinc, native gold, iron (Skylark, Independence & Galena Mines)	none	not anticipated
Tunnel Springs Mountains	unknown	none	not anticipated

In 2012, the State of Utah Division of Oil, Gas and Mining's (UDOGM) Abandoned Mine and Reclamation Program coordinated with us to implement avoidance and minimization measures for

Frisco clover when closing mine openings in the vicinity of the species. The purpose of closing the mine openings is for human safety and does not indicate that a mine is permanently closed to future mining. Once closed, a mine may be reopened again by the claimant at any time. As of 2014, UDOGM had completed the closure of 150 abandoned mine openings (Rohrer 2015a, p. 1). To date, Frisco clover has not been found at or near any of the completed or proposed mine closing locations (Transcon Environmental 2012). Additionally, there are no plans to complete future mine closures in the San Francisco range where the Grampian Hill and San Francisco populations occur (Rohrer 2015b, p. 1).

Gravel Mining

Gravel mining is known to occur within Frisco clover's range, particularly in the San Francisco Mountains and Wah Wah Mountains. The San Francisco and Grampian Hill populations of Frisco clover occur in the San Francisco Mountains on soils derived from Ordovician limestone. In addition to precious metals, this formation is mined for crushed limestone. The limestone is removed from quarry sites and sold for marble landscaping gravel. Marble landscaping gravel quarries in Frisco clover's range are open-pit mines that result in the removal of the habitat substrate for these species.

Gravel mining results in surface disturbance, increased foot and vehicle traffic, vegetation disturbance, and removal of top soil and overburden. The bedrock deposits sought for crushed gravel are found at ground level and extend to various depths within the Ordovician limestone deposit. This means that surface materials are removed and the plant's habitat including its seed bank may be permanently lost. Stockpiled materials that include a reject pile of finer particles and possibly a shallow topsoil layer are used to reclaim the area (Ginouves 2015c, p. 1). Potential impacts to Frisco clover from these activities include mortality of individuals, localized population mortality, habitat loss, degradation and fragmentation, increased soil erosion, reductions in pollinator populations, reductions in plant vigor and reproductive potential, reductions in seed bank quantity and quality, and increasing invasive plant occurrences (Brock and Green 2003; BLM 2008c).

Past and current gravel mining has occurred in the San Francisco population of Frisco clover and has likely impacted this population. The San Francisco population occupies only 15 ac (6 ha) of habitat and is distributed across three sites (Copper Gulch, Cactus Mine, and Indian Queen) (Figure 1; Table 1; Darnall *et al*. 2010, entire). Two active gravel quarries are located within 1,000 ft (300 m) of two sites (Cactus Mine and Copper Gulch) within the San Francisco population. Based on habitat similarities and proximity, we estimate that 19 ac (8 ha) of suitable habitat was disturbed by past and current gravel mining activities near the San Francisco population of Frisco clover. We believe the species may have occupied these areas prior to the mining activity and that past impacts resulted in the loss of 56 percent of the habitat for the San Francisco population.

We anticipate gravel mining will impact the San Francisco and Grampian Hill populations of Frisco clover in the future (Table 2). In the San Francisco population, there is no current mining activity at the two gravel mines but they are considered active by the State of Utah because they have not

been reclaimed and have the potential to expand in the future. Given the close proximity of these two gravel quarries to known Frisco clover plants in the San Francisco population, these operations could impact the remaining occupied habitat of the population through additional quarrying activities (i.e., removal of the entire substrate) or when roads and other infrastructure are constructed. Future expansion of the existing gravel mining operations into the San Francisco population may result in the complete extirpation of plants and substrate of this population.

Although gravel mining is not actively occurring at the Grampian Hill population, one gravel mine is located within 1 mile (mi)(1.6 kilometers (km)) of this population. This gravel mine, the Southern White/Mountain Rose mine, is active and expanding under a UDOGM small mine permit (Ginouves 2015, p. 1). An additional 2.5 acres of disturbance is anticipated under the current permit (Brinton 2015a, p. 1), and the operator notified the State of plans to construct a new road below the mine to improve access (Brinton 2016a, p. 1). This marble gravel mining operation provides landscape gravel to Home Depot stores nationwide from a distribution center near Milford, Utah (Munson 2010, pers. comm.). Due to the limited extent of the Ordovician limestone deposits in the San Francisco Mountain range, it is likely that future mining activities will occur at the Grampian Hill population. In addition to future gravel mining, we previously established that this population is likely to be impacted by future precious metal mining (see *Precious Metal Mining*, above). Expansion of the existing gravel mining operations in conjunction with future precious metal mining has the potential to result in the complete extirpation of this population.

The Blue Mountain population of Frisco clover occurs in the Wah Wah Mountains on soils derived from the Temple Cap formation that includes limestone, sandstone and siltstone. This formation is mined for crushed gravel for use in road construction projects.

The Courgraph gravel mine occurs in the vicinity of the Blue Mountain population. This mine is located on SITLA lands within 300 to 500 feet (91 to 152 meters) of the population (Evenden 1998, p. 9; Darnall *et al.* 2010, entire; Roth 2010, p. 4). There is no current mining activity at this mine; however, the operator just notified the State of plans to expand the quarry by approximately 1 acre (ac) (0.4 hectare (ha)) to the west and upslope of the existing mine (Brinton 2016a, p. 1). This population is extremely small in acreage (less than 1 ac (0.4 ha)) and it may be possible for the proposed expansion to avoid this population. We will meet with the State to discuss potential impacts and will continue to work with our partners to avoid or minimize impacts to this population.

The likely continuation and future expansion of gravel mining within three Frisco clover populations (San Francisco, Grampian Hill, Blue Mountain) is supported by economic forecasts of an increasing future demand for gravel sources for use in road construction and urban landscapes in order to support future human population growth in nearby Washington and Iron counties (U.S. Census Bureau 2010b, entire; Utah GOPB 2010, p. 48). Construction sand, gravel, and crushed stone together rank as the second most valuable commodity produced among industrial minerals in Utah (Bon and Krahulec 2009, p. 5). Gravel, stone, and rock are generally mined for local and regional distribution due to the high cost of transport. The gravel mines in the San Francisco Mountains are the closest crushed limestone gravel mines to Washington County, one of the fastest growing counties in Utah (Mine Safety and Health Administration 2010, p. 1). In general, there has been a

net loss of local sand and gravel supply mines in the Washington County area due to ongoing urban development and the lack of available gravel mine operations on surrounding Federal lands (Blackett and Tripp 1999, p. 33). The close proximity of the existing gravel mining operations within the range of Frisco clover to Washington County make it likely that these operations will become a primary source of gravel for Washington County and other nearby communities. In addition to regional distribution, crushed limestone quarried from the vicinity of the Copper Gulch, Indian Queen, and Cupric Mine populations is transported to a distribution center for the Home Depot in the nearby town of Milford, where it is packaged and shipped nationwide (Munson 2010, pers. comm.).

To summarize, precious metal mining and gravel mining has occurred throughout large portions of Frisco clover's range and within four of the five populations (Table 1; Table 2). Available information suggests that three of the five populations will be significantly impacted by either precious metal or gravel mining in the foreseeable future. Precious metal mining and gravel mining activity is anticipated to increase within the species range within the foreseeable future and will likely continue to impact the three populations of Frisco clover that comprise 75 percent of the estimated total population. Future mining activity will likely result in the loss of plants and available habitat and has the potential to lead to the complete extirpation of all three populations that comprise 75 percent of the estimated total population. Therefore, mining is a threat to Frisco clover now and in the foreseeable future.

Nonnative Invasive Species

The spread of nonnative invasive species is considered the second largest threat to imperiled plants in the United States (Wilcove *et al*. 1998, p. 608). Invasive plants—specifically exotic annuals such as cheatgrass (*Bromus tectorum*)—negatively affect native vegetation, including rare plants. One substantial effect of cheatgrass is the change in vegetation fuel properties that, in turn, alter fire frequency, intensity, extent, type, and seasonality (Menakis *et al*. 2003, pp. 282–283; Brooks *et al*. 2004, p. 677; McKenzie *et al*. 2004, p. 898). Shortened fire return intervals make it difficult for native plants to reestablish or compete with invasive plants (D'Antonio and Vitousek 1992, p. 73). Invasive plants can reduce the abundance of native plants by outcompeting natives for soil nutrients and water (Melgoza *et al*. 1990, pp. 9–10; Aguirre and Johnson 1991, pp. 352–353). They can also completely exclude native plants from their habitat and alter pollinator behaviors (D'Antonio and Vitousek 1992, pp. 74–75; DiTomaso 2000, p. 257; Mooney and Cleland 2001, p. 5449; Levine *et al*. 2003, p. 776; Traveset and Richardson 2006, pp. 211–213).

The annual nonnative invasive grass, cheatgrass, is considered the most ubiquitous invasive species in the Intermountain West due to its ability to rapidly invade native dryland ecosystems and outcompete native plant species (Mack 1981, p. 145; Mack and Pyke 1983, p. 88; Thill *et al*. 1984, p. 10). If already present in the vegetative community, cheatgrass can increase in abundance after a wildfire, increasing the chance for more frequent fires (D'Antonio and Vitousek 1992, pp. 74–75; Brooks and Pyke 2002, p. 5; Grace *et al*. 2002, p. 43; Brooks *et al*. 2003, pp. 4, 13, 15). The risk of fire is expected to increase from 46 to 100 percent when the cover of cheatgrass increases from 12 to 45 percent or more (Link *et al*. 2006, p. 116). In the absence of exotic species, it is generally

estimated that fire return intervals in xeric sagebrush communities range from 100 to 350 years (Baker 2006, p. 181). In some areas of the Great Basin (e.g., Snake River Plain), fire return intervals due to cheatgrass invasion are now between 3 and 5 years (Whisenant 1990, p. 4). In addition, cheatgrass can invade areas in response to surface disturbances (Hobbs 1989, pp. 389, 393, 395, 398; Rejmanek 1989, pp. 381–383; Hobbs and Huenneke 1992, pp. 324–325, 329, 330; Evans *et al*. 2001, p. 1308). Cheatgrass is likely to increase due to climate change (see Factor E) because invasive annuals increase biomass and seed production at elevated levels of carbon dioxide (Mayeux *et al*. 1994, p. 98; Smith *et al*. 2000, pp. 80–81; Ziska *et al*. 2005, p. 1328).

In the absence of annual nonnative species, Frisco clover grows in sparsely vegetated communities that are unlikely to carry fires (see Habitat/Life History section). However, now cheatgrass occurs in the habitat and vicinity of the Grampian Hill and San Francisco populations, which also is where the majority of the Frisco clover plants occur (Table 1; Miller 2010c, pp. 2–5; Roth 2010, p. 1). Increased mining activities and associated surface disturbances are anticipated to occur in and adjacent to three Frisco clover populations in the San Francisco and Blue Mountains (see Mining, above), which will likely promote cheatgrass expansion into the species' habitat. Cheatgrass cover is low, no more than 5 percent of the cover in the Lime Mountain and Tunnel Springs populations (Red Butte Garden 2015, p. 2) and within undisturbed habitat at the remaining populations, based on photographs (Roth 2010, pp. 5 – 8). However, given the ubiquitous distribution of cheatgrass in the Intermountain West, we expect it occurs in the vicinity of all populations and will quickly spread following disturbance (Novack and Mack 2001, p. 115).

In our 2011 12-month finding, we identified invasive nonnative plants as a threat to Frisco clover. However, since that time we have received additional information that indicates the historical fire regime within the range of Frisco clover appears to be more frequent than we previously inferred from the best available scientific literature. Historical fire return intervals in the Wah Wah Mountains within the range of Frisco clover varied widely from 24.8 – 100.2 years (Kitchen 2012, p. 58). For areas with a documented fire record in the Wah Wah Mountains, these fire intervals are much shorter than the 100 – 350 year interval we state above for xeric sagebrush communities. Additionally, fires have been less frequent in the Wah Wah Mountains since Euro-American settlement than the historical fire frequency (Kitchen 2012, p. 64). This is the opposite trend of many areas dominated by sagebrush in the Western United States (Bukowski and Baker, p. 546, 558). This information indicates Frisco clover experienced more frequent fires in the past and that an increase in fire frequency in the future may not negatively impact the species if it returns to a similar historical fire frequency. We also cannot state that cheatgrass is likely to establish the coverage and continuity of fine fuels within intact Frisco clover habitat that would promote an altered fire regime much shorter than the historical regime. The habitat differences are too great between Frisco clover habitat and cheatgrass dominated sagebrush habitats for us to suggest this is in fact the case. Both the soil type and higher elevation of Frisco clover habitat are not consistent with the well-developed soils and lower elevations of cheatgrass dominated habitats (Chambers *et al*. 2007, pp. 139 – 140; Chambers *et al*. 2013, p. 366, 370; Davis and Pelsor 2001, p. 421 - 422). Other poorly developed soils were highly resistant to cheatgrass invasion and had a low risk of an altered fire regime (Davies and Hulet 2014, p. 7).

Although it is possible for cheatgrass to spread within Frisco clover habitat without associated surface disturbance, various environmental factors and ecosystem attributes influence a plant community's resiliency and resistance to cheatgrass invasion (Chambers *et al.* 2013, pp. 365 – 366; Davies and Hulet, 2014, pp. 1 – 2), and a careful analysis of the existing integrity of the habitat and its response to disturbance is needed to assess a community's risk of cheatgrass invasion and dominance (Chambers *et al.* 2013, pp. 365 – 366). At this time, we have low coverage estimates of cheatgrass in two populations, and photographs depict little to no cheatgrass in intact habitat in the remaining populations. One field report mentioned cheatgrass was a dominant species along the lower slopes of the Grampian Hill population, likely occupying highly disturbed areas from past mining activity (Roth 2010, p. 1). This stressor's impact to Frisco clover may not be as robust or imminent in intact habitat as previously believed. However, this stressor (cheatgrass) is likely to increase in the future due to increased disturbance from mining activities (see Mining, above).

In summary, we have limited information on how much nonnative invasive weeds have impacted Frisco clover across its range, although it is likely this is a stressor that will increase in the future due to increased disturbance from mining and potentially climate change. Based on new information, we do not currently consider nonnative invasive species alone to be a threat to Frisco clover. However, with the amount of mining that is likely to occur across the range of the species in the future (see *Mining*, above), and the likelihood that nonnative invasive species will increase with surface disturbance from mining, we conclude that nonnative invasive species, when evaluated cumulatively with mining activities, are a future threat to Frisco clover.

Summary of Factor A

Mining activities impacted Frisco clover habitat in the past and are likely to continue to negatively impact the species and its habitat at three populations that comprise 75 percent of the estimated total population in the foreseeable future. We anticipate an increase in the demand for precious metals and landscape rock based on the economic outlook for these commodities, regional availability, and the proximity of these gravel mines to a rapidly expanding urban area and, therefore, an increase in impacts to Frisco clover. Two of the five populations and the majority of individuals are located on lands with an extensive history of precious metal mining and ongoing exploration activities indicate that precious metal mining is likely to continue to occur in the species habitat in the foreseeable future. The main threat to the majority of the total Frisco clover individuals is gravel mining (Table 2). Three of the five populations are located in the vicinity of gravel mines that are used for road and landscaping gravel and will likely be mined for gravel in the future (Table 2). These three populations contain the majority of the total individuals (75 percent) and will likely be significantly impacted by future mining. Mining activity is anticipated to result in the loss of large numbers of individuals and gravel mining has the potential to completely extirpate three Frisco clover populations by the wholesale removal of plants and substrate within these populations.

Cheatgrass occurs in the two largest of the five populations of Frisco clover, but we have no information that cheatgrass is spreading within undisturbed habitat or will likely establish a fine fuel layer in undisturbed habitat that supports an altered fire regime. The invasion and expansion of

annual nonnative species will likely be exacerbated by mining activities (see Factor A) and possibly global climate change (see Factor E). Small population sizes and the extremely limited distribution of Frisco clover make it vulnerable to stochastic extinction events, including mining activities and an increase in annual nonnative species (see Factor E).

Therefore, the present or threatened destruction, modification, or curtailment of the species' habitat or range is a threat to Frisco clover, now and in the foreseeable future, based on impacts from mining activities and nonnative invasive species.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

Frisco clover is not a plant of horticultural interest. We are not aware of any overutilization or collection of Frisco clover. Therefore, overutilization for commercial, recreational, scientific, or educational purposes does not appear to pose a threat to the species now nor is it likely to become a threat in the foreseeable future.

C. Disease or predation:

Disease and herbivory on the species are unknown. We do not have any information indicating that disease is impacting Frisco clover. We also do not have any information indicating that herbivory is occurring from livestock, wildlife, or insects (Kass 1992, p. 10; Evenden 1998, entire; Evenden 1999, entire; Miller 2010c, entire; Miller 2010e, p. 1; Roth 2010, entire; Hildebrand 2013, entire). Thus, we do not consider disease or predation to be threats to this species.

D. The inadequacy of existing regulatory mechanisms:

There are no endangered species laws protecting plants on private, State, or Tribal lands in Utah. The majority (70 percent) of individual plants are located on SITLA or private lands (Table 1). Frisco clover is listed as a bureau-sensitive plant for the BLM. Limited policy-level protection by the BLM is afforded through the Special Status Species Management Policy Manual # 6840, which forms the basis for special status species management on BLM lands (BLM 2008b, entire). The two sites on USFS lands are located within the Desert Experimental Range in the Tunnel Springs Mountains (Tunnel Springs population) and appear to be secure, although the population has not been visited since 1992 (Kass 1992, p. 11; Evenden 1998, Appendix C; Evenden 1999, p. 3).

This species is predominantly located on private or SITLA lands (Table 1), where mining-related activities are the predominant threat (see Factor A). There are limited regulatory mechanisms in place that may protect Frisco clover from mining on private or State lands. The Utah Mined Land Reclamation Act mandates the preparation of State environmental impact assessments for large mining operations (or operations above 10-ac (4-ha) in size) for all mineral exploration, development, and extraction, including gravel pits and precious metal mining in unincorporated areas (UDOGM 2010b, p. 1; Baker 2010, pers. comm.; Brinton 2015b, p.1). The existing mining activities (see Factor A) in the vicinity of Frisco clover populations are under UDOGM's 10-ac

(4-ha) regulatory threshold and, therefore, not subject to environmental review during the permit process (Brinton 2015b, p.1). Frisco clover is not State listed, but it is on the BLM sensitive species list. If UDOGM is made aware of impacts to these species, they could consider minimizing and mitigating impacts; however, there is no requirement to address species that are not federally listed in UDOGM's mine permitting process (Baker 2010, pers. comm.). Therefore, the Utah Mined Land Reclamation Act is inadequate to protect Frisco buckwheat from expansion of mining activities into its habitat.

In summary, the existing regulatory mechanisms are not adequate to protect Frisco clover from the threat of precious metal or gravel mining on SITLA and private lands. The active gravel pits are below the 10-ac (4-ha) threshold that would automatically trigger regulatory environmental impact assessments. However, even if an environmental impact assessment is completed for any of the mines, the existing mining laws only recommend, and do not mandate, the species' protection or mitigation. Therefore, the existing mechanisms to regulate mining activities on private and State lands are not addressing threats to three of five populations with the majority of individuals.

E. Other natural or manmade factors affecting its continued existence:

Below we evaluate potential natural and manmade threats to Frisco clover's survival including small population size and climate change and drought.

Small Population Size

Small populations and species with limited distributions are vulnerable to relatively minor environmental disturbances (Given 1994, pp. 66–67). No information is available on the population genetics, pollination, or reproductive effort and success of Frisco clover. However, we do know that small populations are at an increased risk of extinction due to the potential for inbreeding depression, loss of genetic diversity, and lower sexual reproduction rates (Ellstrand and Elam 1993, entire; Wilcock and Neiland 2002, p. 275). Lower genetic diversity may, in turn, lead to even smaller populations by decreasing the species' ability to adapt, thereby increasing the probability of population extinction (Barrett and Kohn 1991, pp. 4, 28; Newman and Pilson 1997, p. 360).

The entire range of Frisco clover is restricted to highly specialized habitat niches, distributed in 5 populations (and 10 sites) with a total population estimate of 12,675 plants. Four of the 10 sites contain 500 or fewer individuals (Table 1). Only a fraction of the entire species' range is occupied habitat. The majority of plants are located in two populations containing four sites of occupied habitat, ranging from an estimated 1 ac (0.4 ha) to a maximum of 12 ac (5 ha) (Darnall *et al*. 2010, entire; Miller 2010b, Appendix B).

Mining or a single random event, such as a wildfire from invasive species (see Factor A), could extirpate an entire or at least a substantial portion of a population, given the small areas of occupied habitat. Species with limited ranges and restricted habitat requirements also are more vulnerable to the effects of global climate change (see Climate Change and Drought, below) (IPCC 2002, p. 22; Jump and Penuelas 2005, p. 1016; Machinski *et al*. 2006, p. 226; Krause 2010, p. 79).

In the absence of information identifying threats to the species and linking those threats to the rarity of the species, we would not consider rarity alone to be a threat. A species that has always been rare, yet continues to survive, could be well equipped to continue to exist into the future. Overall, we consider small population size an intrinsic vulnerability of Frisco clover, because it occurs in five highly localized small populations. At this point in time, we conclude that small population size is a concern for Frisco clover given the likelihood of future mining impacts that will likely reduce the size of or extirpate three populations that comprise the majority of the total individuals (see Factor A).

Climate Change and Drought

Our analyses under the ESA include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Hot extremes, heat waves, and heavy precipitation will increase in frequency due to climate change, with the Southwest experiencing the greatest temperature increase in the continental United States (Karl *et al*. 2009). Approximately 20 to 30 percent of plant and animal species are at increased risk of extinction if increases in global average temperature exceed 2.7 to 4.5 degrees Fahrenheit (°F) (1.5 to 2.5 degrees Celsius (°C)) (IPCC 2007, p. 48). In the southwestern United States, average temperatures increased approximately 1.5 °F (0.8 °C) compared to a 1960 to 1979 baseline (Karl *et al*. 2009, p. 129). By the end of this century, temperatures are expected to warm a total of 4 to 10 °F (2 to 5 °C) in the Southwest (Karl *et al*. 2009, p. 129).

Annual mean precipitation levels are expected to decrease in western North America and especially the southwestern States by mid-century (IPCC 2007, p. 8; Seager *et al*. 2007, p. 1181). The levels of aridity of recent drought conditions and perhaps those of the 1950s drought years will become the new climatology for the southwestern United States (Seager *et al*. 2007, p. 1181). Although droughts occur more frequently in areas with minimal precipitation, even a slight reduction from normal precipitation may lead to severe reductions in plant production. Therefore, the smallest change in environmental factors, especially precipitation, plays a decisive role in plant survival in arid regions (Herbel *et al*. 1972, p. 1084).

Atmospheric levels of carbon dioxide are expected to double before the end of the 21st century, which may increase the dominance of invasive grasses leading to increased fire frequency and

severity across western North America (Brooks and Pyke 2002, p. 3; IPCC 2002, p. 32; Walther *et al*. 2002, p. 391). Elevated levels of carbon dioxide lead to increased invasive annual plant biomass, invasive seed production, and pest outbreaks (Smith *et al.* 2000, pp. 80–81; IPCC 2002, pp. 18, 32; Ziska *et al*. 2005, p. 1328) and will put additional stressors on rare plants already suffering from the effects of elevated temperatures and drought.

Climate change effects present substantial uncertainty regarding the future environmental conditions in the range of Frisco clover and may place an added stress on the species and its habitat. Although we have no information on how Frisco clover will respond to effects related to climate change, persistent or prolonged drought conditions are likely to reduce the frequency and duration of flowering and germination events, lower the recruitment of individual plants, compromise the viability of populations, and impact pollinator availability (Tilman and El Haddi 1992, p. 263; Harrison 2001, p. 78). Drought conditions led to a noticeable decline in survival, vigor, and reproductive output of other rare and endangered plants in the Southwest during the drought years of 2001 through 2004 (Anderton 2002, p. 1; Van Buren and Harper 2002, p. 3; Van Buren and Harper 2004, entire; Hughes 2005, entire; Clark and Clark 2007, p. 6; Roth 2008a, entire; Roth 2008b, pp. 3–4). Similar responses are anticipated to adversely affect the long-term persistence of Frisco clover.

As discussed in the Small Population Size section above, Frisco clover has a limited distribution and populations are localized and small. In addition, these populations are restricted to very specific soil types. Global climate change exacerbates the risk of extinction for species that are already vulnerable due to low population numbers and restricted habitat requirements (IPCC 2002, p. 22; Jump and Penuelas 2005, p. 1016; Machinski *et al*. 2006, p. 226; Krause 2010, p. 79).

The actual extent to which climate change itself will impact Frisco clover is unclear, mostly because we do not have long-term demographic information that allows us to predict the species' response to changes in environmental conditions, including prolonged drought. However, as previously described, mining activities are a threat to the species (see Factor A, above), which will likely result in the loss of large numbers of individuals or even entire populations. Increased surface disturbances associated with mining activities will likely increase the extent and densities of nonnative invasive species in the habitat (see Factor A, above). The cumulative effects of the potential reduction in population numbers and habitat loss (of already small populations) associated with mining and increased invasive species are likely to increase the risk of the species being impacted by changes in climate.

In summary, we find it difficult to analyze the potential effects of global climate change on Frisco clover in the absence of demographic trend data for the species which would allow us to analyze how the species responds to climate change through time. However, the cumulative effects posed by mining, nonnative species and small population size may exacerbate the effects of climate change on Frisco clover in the future. However, at this time, we believe that the state of knowledge concerning the localized effects of climate change within the habitat occupied by Frisco clover is

too speculative to determine whether climate change is a threat to this species in the foreseeable future. We will continue to assess the potential of climate change to pose a threat to the species as better scientific information becomes available.

Summary of Factor E

We assessed the potential risks of small population size, climate change, and drought to Frisco clover populations. Frisco clover has a highly restricted distribution and is known from five small, localized populations. Even in the absence of information on genetic diversity, inbreeding depression, and reproductive effort, a random stochastic event could impact a substantial portion of a population. Small populations that are restricted by habitat requirements are also more vulnerable to the effects of climate change, such as prolonged droughts and increased fire frequencies.

While naturally occurring droughts are not likely to impact the long-term persistence of the species, an increase in periodic prolonged droughts due to climate change is likely to impact the species across its entire range in the future. Global climate change, particularly when assessed cumulatively with small population size and threats from mining activities, is expected to increase the density of invasive annual grasses, which are already present in the habitat of Frisco clover within the populations that contain the majority of the plants (see Factor A).

Although small population size and climate change make the species intrinsically more vulnerable, we are uncertain whether they would rise to the level of threat by themselves. However, when combined with the threats listed under Factor A, small population size may rise to the level of threat in the foreseeable future. At this time, we are uncertain of the degree to which climate change constitutes a threat to the species. We will continue to assess the potential of climate change to pose a threat to the species as better scientific information becomes available.

Conservation Measures Planned or Implemented :

Data collection through 2012 contributed to our knowledge of the current status of Frisco clover populations. The information provided by this effort improved our understanding of the relative importance of the various factors implicated in the species' extinction risk. The BLM worked with the Southern Utah University (SUU) to conduct inventories for Frisco clover and provide baseline information on its distribution (Pontarolo 2013, pers. comm.). During the summer of 2012, SUU surveyed for additional locations of Frisco clover (Hildebrand 2013, pers. comm.). They found one additional site within the Lime Mountain population on BLM land that expands the size and boundary of the known population (Hildebrand 2013, p. 18). Future surveys in the Wah Wah Mountains may locate additional populations on BLM lands and provide us with a better understanding of the species' distribution, abundance, and threats. A new population of Frisco clover in the northern Wah Wah Mountains was recently reported andnow thought to be another closely related clover, *Trifolium andinum*; however, additional review is needed to verify the taxonomy.

The Nature Conservancy of Utah initiated communication with the Horn Silver Mine to discuss the potential for establishing conservation measures, including potential conservation easements for

the populations on private lands (York 2013, pers. comm.). At the time, Horn Silver Mine was not interested in protecting the species (York 2013, pers. comm.).

Red Butte Garden collected seeds in 2015 from the Lime Mountain and Tunnel Spring populations to evaluate the germination and viability of seeds and to place seeds in long-term storage (Red Butte Garden 2015, entire). Additional seed collections from the remaining populations are needed, but depend on funding and the willingness of landowners to grant access.

Summary of Threats :

The primary threat to Frisco clover is habitat destruction from precious metal and gravel mining on private and SITLA lands (Factor A). The largest populations containing the majority of Frisco clover plants are located on private lands with active mining claims. These populations were likely impacted by historical precious metal mining. Another population is located on SITLA lands in the immediate vicinity of a gravel pit that is planning to expand. We expect an increase in precious metal and gravel mining in the foreseeable future, with the associated loss and fragmentation of Frisco clover populations.

Cheatgrass occurs in the vicinity of the two largest populations of the five known Frisco clover populations. It is a highly invasive species and is expected to increase in areas where surface disturbance from mining occurs. Global climate change is expected to increase drought conditions in the Southwest and increase the spread of nonnative invasive species. The biggest concern associated with the increase in invasive species is an increase in vegetative competition, a reduction in the suitability of occupied habitat, and possibly an altered fire regime (Factor A), particularly when considering the small population sizes and small occupied habitat acreages associated with the species.

The magnitude of the biological threats posed by the small population size and limited species range are not well understood due to the lack of information available on the ecology of Frisco clover. Future studies may provide us with a more thorough understanding of threats posed by pollinator limitation, inbreeding depression, and the potential lack of genetic diversity over the species' range. Even without detailed knowledge on how small population sizes are impacting the biology and ecology of Frisco clover, the small areas of occupied habitat make the species highly vulnerable to habitat destruction through mining-related activities as well as random extinction events, including fires and the effects of global climate change (Factor E).

The existing regulatory mechanisms are not adequate to protect Frisco clover from the primary threat of mining, particularly because the majority of individuals are located on private lands (Factor D). The inadequacy of regulatory mechanisms (Factor D) on private and State lands, combined with the high economic and commercial value of much of the substrate this species depends on, poses a serious threat to Frisco clover. A large portion of the species' individuals have the potential to be extirpated by mining activities in the foreseeable future (Factor A; Table 2). Ongoing mining in the habitat of Frisco clover has the potential to extirpate three of the five populations in the foreseeable future, two of which contain the majority of plants (Factor A, Table 1).

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

- Pursue habitat protection for existing populations on SITLA and private lands through land purchases or exchanges, conservation easements, and candidate conservation agreements.
- Determine habitat suitability on federal lands for future surveys and introduction efforts.
- Develop successful propagation methods and pursue long-term seed collection.
- Determine pollinators and pollinator requirements.
- Implement pilot introductions within suitable or reclaimed habitat on Federal or protected lands.
- Determine the taxonomy of the clover found in the Wah Wah Mountains.

Priority Table

Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	**Imminent**	Monotypic genus	7
		Species	**8**
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

Rationale for Change in Listing Priority Number:

Magnitude:

Moderate.

We consider the threats that Frisco clover faces to be moderate in magnitude because the major threats (mining and nonnative species associated with mining activity), vulnerabilities (small population size and climate change), and the inadequacy of existing regulatory mechanisms, while serious and occurring rangewide, do not collectively rise to the level of high magnitude. For example, although mining for precious metals and gravel historically occurred throughout Frisco clover's range, and mining operations may eventually expand into occupied habitats, there is no active mining within the immediate vicinity of any known population (except for an un-reclaimed gravel mine within several hundred feet of the small, approximately 1-ac (0.4-ha) Blue Mountain population). Additionally, expansion plans for the gravel mine next to the Blue Mountain population will be reviewed by the State of Utah and avoidance of occupied habitat appears to be feasible at this time (Brinton 2016b, p. 1).

By removing the unique limestone and dolomite soils, mining destroys both occupied and suitable habitats while promoting the spread of cheatgrass. Cheatgrass currently occurs within only two of the five known Frisco clover population areas, although future levels will likely increase as a result of surface disturbance associated with mining activities.

Existing regulatory mechanisms do not adequately protect the species from mining on private lands. The impact of the inadequacy of regulatory mechanisms is moderate because none of the populations are directly impacted by current mining. Finally, although small population size and climate change make the species intrinsically more vulnerable to other threats, we are uncertain whether small populations and climate change individually rise to the level of threat. When analyzed cumulatively with threats associated with mining, these factors may rise to the level of threat in the foreseeable future. Therefore, we consider the threats moderate in magnitude.

Imminence :

Imminent. We consider all of the threats to be imminent because the threats are identifiable and the species currently faces them across its entire range. Although gravel mining currently occurs near only one of the five populations, active permits, recent prospecting, and development plans within occupied and suitable habitats suggest that mining operations may restart or expand at any time in the foreseeable future. Because the mining operations are small scale, we will likely not be notified by UDOGM when these activities within habitat occur. Additionally, cheatgrass spreads rapidly and we expect will quickly colonize the habitats of all five Frisco clover populations with additional surface disturbance from mining operations, thus further reducing the suitability of available habitats and increasing the potential for wildfire. We expect that imminent impacts from mining, nonnative species, small population size, and climate change will continue and likely intensify into the foreseeable future.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

We determined that issuing an emergency regulation temporarily listing the species is not warranted at this time because there is no emergency posing a significant risk to the well-being of Frisco clover. We do not believe that any of the potential threats are of such great immediacy and severity that would threaten all of the known populations with the imminent risk of extinction. However, if at any time we determine that issuing an emergency regulation temporarily listing Frisco clover is warranted, we will initiate emergency listing at that time.

Description of Monitoring:

SUU completed their surveys of Frisco clover in 2012 (Pontarolo 2014, pers. comm.). No additional surveys are planned. Additional potential habitat remains un-surveyed in the Wah Wah Mountains and possibly other mountain ranges. Locating potential habitat is hindered by incomplete data on soils and geology in nearby mountain ranges (Hildebrand 2014, pers. comm.). Future surveys may locate additional populations on BLM lands and provide us with a better understanding of the species' distribution, abundance, and threats. We are also coordinating with the Nature Conservancy to pursue landowner contact and open a dialogue on the conservation of the species on private lands. Additional surveys in the northern Wah Wah Mountains may be performed in 2015 following the verification of the new Frisco clover population.

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

Utah

Indicate which State(s) did not provide any information or comment:

none

State Coordination:

Frisco clover is endemic to Utah. UDOGM provided information for this assessment. No new information about the status of this species was available from the Utah Natural Heritage Program (UNHP) for this review. The UNHP actively tracks the status of this species and we will incorporate any updates or new information gathered in future assessments.

Literature Cited:

Aguirre, L. and D.A. Johnson. 1991. Influence of temperature and cheatgrass competition on seedling development of two bunchgrasses. Journal of Range Management 44: 347–354.

Anderton, L. 2002. Summary of Spence's *Schoenocrambe barnebyi* Monitoring Plot, 1998–2001.

Unpublished report prepared for the Capitol Reef National Park. 1 pp.

Baker, P. 2010. Environmental Manager. Minerals Reclamation Program. Utah Division of Oil, Gas, and Mining. Telephone conversation with D. Roth, Botanist, USFWS Utah Field Office, Salt Lake City, UT. October 25, 2010.

Baker, P. 2015. Environmental Manager. Minerals Reclamation Program. Utah Department of Oil, Gas, and Mining. Personal communication with Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. April 16, 2015. 1 p.

Baker, W.L. 2006. Fire and Restoration of Sagebrush. Wildlife Society Bulletin, Vol. 34, No. 1 (2006), pp. 177–85.

Baker, W.L. In press. Pre-Euroamerican and recent fire in sagebrush ecosystems. Studies in Avian Biology. 50 pp.

Barrett S.C.H. and J.R. Kohn. 1991. Genetic and evolutionary consequences of small population size in plants: implications for conservation. In Genetics and Conservation of Rare Plants, ed. D.A. Falk, K.E. Holsinger, pp. 3–30. New York: Oxford Univ. Press.

Bon, R.L. and K. Krahulec. 2009. 2008 Summary of mineral activities in Utah. Utah Geological Survey. Circular 109, 14 pp.

Brinton, P. 2015a. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 24, 2015. 1 p.

Brinton, P. 2015b. Utah Department of Oil, Gas, and Mining Environmental Scientist Engineer. Personal communication with Jennifer Lewinsohn USFWS UT Field Office, Salt Lake City, UT. April 16, 2015. 1 p.

Brinton, P. 2016a. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 10, 2016. Utah Department of Oil, Gas, and Mining Environmental Scientist Engineer. 1 p.

Brinton, P. 2016b. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 31, 2016. Utah Department of Oil, Gas, and Mining Environmental Scientist Engineer. 1 p.

Brock, J.H. and D. M. Green. 2003. Impacts of livestock grazing, mining, recreation, roads, and other land uses on watershed resources. Journal of the Arizona–Nevada Academy of Science, Vol. 35(1): 11–22.

Brooks, M.L. and D. Pyke. 2002. Invasive plants and fire in the deserts of North America. p. 1–14 In: K. Galley and T. Wilson (eds.), Proceedings of the Invasive Species Workshop: The Role of Fire

In the Control and Spread of Invasive Species. Fire Conference 2000: The First National Congress on Fire, Ecology, Prevention and Management. Miscellaneous Publications No. 11, Tall Timbers Research Station, Tallahassee, Florida, USA.

Brooks, M.L., T.C. Esque and T. Duck. 2003. Fuels and fire regimens in creosotebush, blackbrush, and interior chaparral shrublands. Report for the Southern Utah Demonstration Fuels Project. United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, Montana. 18pp.

Brooks, M., C.M. D'Antonio, D.M. Richardson, J.B. Grace, J.E. Keeley, J.M. DiTomaso, R.J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of Invasive Alien Plants on Fire Regimes. Bioscience Vol. 54(7): 677–688.

Bukowski, B.E. and W.L. Baker. 2013. Historical fire regimes, reconstructed from land-survey data, led to complexity and fluctuation in sagebrush landscapes. Ecological Applications 23(3): 546 – 564.

Bureau of Land Management (BLM). 2008a. Proposed RMP and Final EIS, Chapter 4: Environmental Consequences. 628 pp.

Bureau of Land Management (BLM). 2008b. BLM Manual, MS-6840. Accessed online at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/blm_manual.html on July 26, 2010. OR Bureau of Land Management. 2008. ESA and BLM Guidance and Policy Manual 6840: Special Status Species Management. Revised manual. 48 pp.

Bureau of Land Management (BLM). 2008c. Richfield Field Office Record of Decision and Approved Resource Management Plan, October 2008. 170 p. + Appendices and Maps.

Bureau of Land Management (BLM). 2012. Mineral Potential Report for the Cedar City Planning Area, Cedar City Field Office. 151 pp. + AppendicesChambers, J.C., B.A. Roundy, R.R. Blank, S.E. Meyer, A. Whittaker. 2007. What Makes Great Basin Sagebrush Ecosystems Invasible by *Bromus tectorum*? Ecological Monographs 77(1): 117 – 145.

Chambers, J.C, B.A Bradley, C.S. Brown, C. D'Antonio, M.J. Germino, J.B. Grace, S.P. Hardegree, R.F. Miller, D.A. Pyke. 2013. Resilience to Stress and Disturbance, and Resistance to *Bromus tectorum* L. Invasion in Cold Desert Shrublands of Western North America. Ecosystems 17(2): 360 – 375.

Clark, T.O. and D.J. Clark. 2007. *Sclerocactus wrightiae* monitoring in Capitol Reef National Park. Unpublished report prepared for the Capitol Reef National Park. 23 pp.

D'Antonio, C.M. and P.M. Vitousek. 1992. Biological invasions by exotic grasses, the grass/fire cycle, and global change. Annual Review of Ecology and Systematics 23: 63–87.

Darnall, N., K. McAbee, and D. Roth. 2010. Quarry sites and populations areas for *Eriogonum soredium*, *Lepidium ostleri*, and *Trifolium friscanum*. GIS map. U.S. Fish and Wildlife Service, Utah

Field Office. September 22, 2010.

Davies, K.W. and A. Hulet. 2014. Risk of Exotic Annual Grass-Fire Cycle in Goose Creek milkvetch habitat. Report prepared for the U.S. Fish and Wildlife Service Utah Field Office, Salt Lake City, Utah. 9p.

Davis, M.A. and M. Pelsor. 2001. Experimental support for a resource-based mechanistic model of invisibility. Ecology Letters 4: 421 – 428.

DiTomaso, J.M. 2000. Invasive weeds in rangelands: species, impacts, and management. Weed Science, Vol. 48(2):255–265.

Ellstrand, N.C. and D.R. Elam. 1993. Population genetic consequences of small population size: implications for plant conservation. Annual Review of Ecology and Systematics 24: 217–242.

Evans, R. D., R. Rimer, L. Sperry, and J. Belnap. 2001. Exotic plant invasion alters nitrogen dynamics in arid grassland. Ecological Applications 11:1301–1310.

Evenden, A. 1998. San Francisco Mountain/Grampian Limestone endemics site report. Unpublished report prepared for the Nature Conservancy, Salt Lake City, UT. 12 pp +& appendices.

Evenden, A. 1999. Tunnel Springs Mountains and adjacent West Desert rare plant survey and conservation area analysis. Unpublished BLM challenge cost share project report prepared for the BLM State Office and the Nature Conservancy, Salt Lake City, UT.

Ginouves, E. 2015. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 4, 2015. 1 p.

Ginouves, E. 2015b. “Mineral Potential Report Cover Page”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated May 7, 2015. 1 p.

Ginouves, E. 2015c. “Mineral Potential Report Cover Page”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated May 8, 2015. 1 p.

Given, D. R. 1994. Principles and Practice of Plant Conservation. Timber Press, Portland, Oregon, USA.

Grace, J.B., M.D Smith, S.L. Grace, S.L. Collins, T. 2002. Interactions between fire and invasive plants in temperate grasslands of North America. p. 40–65. In: K. Galley and T. Wilson (eds.), Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: The First National Congress on Fire, Ecology, Prevention and Management. Miscellaneous Publications No. 11, Tall Timbers Research Station, Tallahassee, Florida, USA.

Harrison, R.D. 2001. Drought and the consequences of El NiÃ±o in Borneo: a case study for figs.

Population Ecology, Vol. 43:63–75.

Herbel, C. H., F. N. Ares, R.A. Wright. 1972. Drought effects on a semidesert grassland range. Ecology, Vol. 53(6):1084–1093.

Hildebrand, T. 2013. Southern Utah University Botany Professor. Personal communication with Jennifer Lewingsohn March 22, 2013.

Hildebrand, T. 2013. Frisco Mountain Endemic Plant Study, 2012 Report. Prepared for the BLM Cedar City Office and Southern Utah University, April 2013. 20 p. + Appendix A, B, C.

Hildebrand, T. 2014. “Re: Data request for San Francisco Mt endemic candidate plants_GIS data needed”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. April 3, 2014.

Hobbs, R.J. 1989. The nature and effects of disturbance relative to invasions. Pages 389–405 in J.A. Drake, J.A. Mooney, F. di Castri, R.H. Grove, F.J. Kruger, M. Rejmanek, and M. Williamson, editors. Biological invasions. A global perspective. Wiley, Chichester, England.

Hobbs, R.J. and L.F. Huenneke. 1992. Disturbance, diversity, and invasion: implications for conservation, Conserv. Biol. 6, pp. 324–337.

Hughes, L. 2005. An Update. Arizona Strip Rare Plant Monitoring and Inventory. Unpublished annual report prepared for the BLM AZ Strip District. 18 pp.

Intergovernmental Panel on Climate Change. 2002. Climate Change and Biodiversity. IPCC Technical Paper V. 74pp. + appendices.
http://www.ipcc.ch/publications_and_data/publications_and_data_technical_papers.htm

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.
http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

Jump, A.S. and J. PeÃ±uelas. 2005. Running to stand still: adaptation and the response of plants to rapid climate change. Ecology Letters, Vol. 8:1010–1020.

Karl, T.R., J.M. Melillo, and T.C. Peterson, (eds.). 2009. Global Climate Change Impacts in the United States. Cambridge University Press.

Kass, R. 1992. Status report of *Trifolium friscanum*. Unpublished document prepared for the USFWS Utah Field Office, West Valley City, UT. 18pp.

Kitchen, S. 2012. Historical fire regime and forest variability on two eastern Great Basin fire-sheds (USA). Forest Ecology and Management 285: 53 -66.

Kitchen, S. 2015. “FW: Frisco clover”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 4, 2015. 2 p.

Krause, C. 2010. Conservation ecology of endemic plants of the Colorado Plateau: climate change impacts on range shifts. PhD Thesis. Northern Arizona University, Department of Biological Sciences. 156pp.

Levine, J.M., M. Vila, C.M. D’Antonia, J.S. Dukes, K. Grigulis, S. Lavorel. 2003. Review paper. Mechanisms underlying the impacts of exotic plant invasions. Proceedings: Biological Sciences, Vol. 270(1517): 775–781.

Link, S.O., C.W. Keeler, R.W. Hill, and E. Hagen. 2006. *Bromus tectorum* cover mapping and fire risk. International Journal of Wildland Fire 15:113-119.

Machinski, J., J.E. Baggs, P.F. Quintana-Ascencio, E.S. Menges. 2006. Using population viability analysis to predict the effects of climate change on the extinction risk of an endangered limestone endemic shrub, Arizona cliffrose. Conservation Biology, Vol. 20(1): 218–228.

Mack, R.N. 1981. Invasion of *Bromus tectorum* L. into western North America: An ecological chronicle. Agro-Ecosystems 7:145–165.

Mack, R.N. and D.A. Pyke. 1983. The demography of *Bromus tec*torum: variation in time and space. Journal of Ecology, Vol. 71(1): 69–93.

Mayeux, H.S., H.B. Johnson, and H.W. Polley. 1994. Potential interactions between global change and intermountain annual grasslands. Paper presented at the symposium on "Ecology, Management, and Restoration of Intermountain Annual Rangelands," May 18–22, 1992, Boise, Idaho. General Technical Report INT 313: 95–100.

McKenzie, D., Z. Gedalof, D.L. Peterson, and P. Mote. 2004. Climate Change, Wildfire, and Conservation. Conservation Biology. 18(4): 890–902.

Melgoza, G., R.S. Nowak, and R.J. Tausch. 1990. Soil water exploitation after fire: competition between *Bromus tectorum* (cheatgrass) and two native species. Oecologia 83: 7–13.

Menakis, J.P., D. Osborne, and M. Miller. 2003. Mapping the cheatgrass-caused departure from historical natural fire regimes in the Great Basin, USA. USDA Forest Service Proceedings RMRS-P-29. pp. 281–287.

Miller, L. 2010a. Survey summary for Trifolium friscanum at the Indian Queen Mine. Unpublished report prepared for the BLM Cedar City Field Office. 2 pp.

Miller, L. 2010b. 2010 ARRA wind energy management project BLM, Cedar City Field Office field survey and status report for Eriogonum soredium and Lepidium ostleri. Unpublished report prepared for the BLM Cedar City Field Office. 9 pp + appendices.

Miller, L. 2010c. Individual Special Status Plant Observation Form. Unpublished observation record prepared for the BLM Cedar City Field Office. 3pp.

Miller, L. 2010d. “RE: PS”. Email to Daniela Roth, USFWS UT Field Office, Salt Lake City, UT. September 2, 2010. 9:59AM.

Miller, L. 2010e. “ERISOR, LEPOST, TRIFRI locations””. Email to Daniela Roth, USFWS UT Field Office, Salt Lake City, UT. June 21, 2010.

Miller, L. 2010f. 2010 ARRA wind energy management project BLM, Cedar City Field Office field survey and status report for Trifolium friscanum. Unpublished report prepared for the BLM Cedar City Field Office. 8 pp + appendices.

Mooney, H.A. and E.E. Cleland. 2001. The evolutionary impact of invasive species. PNAS 98: 5446–5451.

Munson, T. 2010. Hydrologist. Department of Oil, Gas, and Mineral, UT. Telephone conversation with Daniela Roth, USFWS UT Field Office, Salt Lake City, UT. October 25, 2010.

Newman, D. and D. Pilson. 1997. Increased probability of extinction due to decreased genetic effective population size: experimental populations of *Clarkia pulchella*. Evolution 51: 354–362.

Pontarolo, C. 2013. “RE: email to Daniela Roth on January 25, 2012". Email to Bekee Hotze, USFWS UT Field Office, Salt Lake City, UT. March 28, 2013.

Pontarolo, C. 2014. “Frisco Mt endemic SUU study”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. April 2, 2014.

Red Butte Garden and Arboretum. 2015. Frisco Mountain Seed Collection Notes, Summary of Work 2015. 3 pages.

Rejmanek, M. 1989. Invasibility of plant communities. Pages 369–388 in J.A. Drake, J.A. Mooney, F. di Castri, R.H. Grove, F.J. Kruger, M. Rejmanek, and M. Williamson, editors. Biological invasions. A global perspective. Wiley, Chichester, England.

Rohrer, C. 2015a. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 5, 2015. 2 p.

Rohrer, C. 2015b. “Data request for San Francisco Mt endemic candidate plants”. Email to Jennifer Lewinsohn, USFWS UT Field Office, Salt Lake City, UT. Dated March 6, 2015. 1 p.

Roth, D. 2008a. Monitoring Report, *Pediocactus bradyi*, Marble Canyon, Coconino Co., AZ. Unpublished report prepared for the Navajo Natural Heritage Program, Window Rock, AZ. 9 pp.

Roth, D. 2008b. Monitoring Report, *Sclerocactus mesae-verdae* Transplant Project Northern Navajo Fairgrounds, Shiprock, San Juan County, NM. Unpublished report prepared for the Navajo

Natural Heritage Program, Window Rock, AZ. 8 pp.

Roth, D. 2010. Field report & population estimate summary, Frisco Mountain endemics. Memorandum to file. June 24, 2010. USFWS Utah Field Office, West Valley City, UT. 8 pp.

Seager, R., T. Mingfang, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. Li, J. Velez, and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. Science 316: 1181–1184.

Smith, S.D., T.E. Huzman, S.F. Zitzer, T.N. Charlet, D.C. Housman, J.S. Coleman, L.K. Fenstermaker, J.R. Seeman, and R.S. Nowak. 2000. Elevated CO2 increase productivity and invasive species success in an arid system. Nature 408: 79–81.

Thill, D.C., K.G. Beck, and R.H. Callihan. 1984. The biology of downy brome (*Bromus tectorum*). Weed Science 32(1): 7–12.

Tilman, D. and A. El Haddi. 1992. Drought and biodiversity in grasslands. Oecologia, Vol. 89(2): 257–264.

Transcon Environmental, Inc. 2012. Rare Plant Survey Summary Report: San Francisco Peak Mine Closure Project, Beaver County, Utah. Transcon Environmental, Inc. 3740 East Southern Avenue, Suite 218. Mesa, Arizona. October 2012. 10 pp. + Appendices.

Traveset, A. and D.M. Richardson. 2006. Biological invasions as disruptors of plant reproductive mutualisms. Trends in Ecology and Evolution 21: 208–216.

Utah Governor's Office of Planning and Budget. 2008. Demographic and economic analysis: Subcounty population projections. Accessed online at http://governor.utah.gov/dea/popprojections.html [accessed September 14, 2010].

Utah Governor's Office of Planning and Budget. 2010. 2010 Economic Report to the Governor. State of Utah. 254 pp. Accessed online at: http://governor.utah.gov/DEA/ERG/2010ERG.pdf [accessed September 14, 2010].

U.S. Census Bureau. 2010. Resident population estimates for the 100 fastest growing U.S. counties with 10,000 or more population in 2009: April 1, 2000 to July 1, 2009. Accessed online at: http://www.census.gov/ [accessed September 14, 2010].

Van Buren, R. and K.T. Harper. 2002. 2001 Status Report *Lesquerella tumulosa*. Kodachrome Bladderpod Demography. Order No. JC-POO-3015A. 9 pp + appendices.

Van Buren, R. and K. T. Harper. 2004. Two-Year annual monitoring report – 2003 & 2004. Holmgren milk-vetch (*Astragalus holmgreniorum*). Unpublished report prepared for the Bureau of Land Management, St. George Field Office, UT. Agreement Number JCA031006. 30pp.

Walther, G. E. Post, P. Convey, A. Menzel, C. Parmesan, T.J.C. Beebee, J. Fromentin, O.

Hoegh-Guldberg, F. Bairlein. 2002. Ecological responses to recent climate change. Nature, Vol. 416:389–395.

Welsh, S.L. 1993. New taxa and new nomenclatural combinations in the Utah flora. Rhodora, Vol. 95(883/884):392–421.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. 2008. A Utah Flora. 4rd ed. Print Services, Brigham Young University, Provo, UT. 1,019 pp.

Whisenant, S. 1990. Changing fire frequencies on Idaho's Snake River plains: ecological and management implications. Pp. 4-10. In: Proceedings from the symposium on cheatgrass invasion, shrub die off and other aspects of shrub biology and management. USFS General Technical Report INT-276.

Wilcock, C. and R. Neiland. 2002. Pollination failure in plants: why it happens and when it matters. Trends in Plant Science Vol. 7 (6): 270–277.

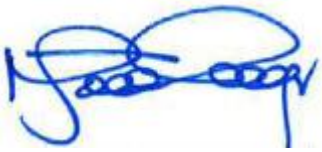
Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. Bioscience Vol. 48(8): 607–615.

York, E. 2013. West Desert Regional Coordinator. The Nature Conservancy, UT. Conversation with Bekee Hotze, USFWS UT Field Office, Salt Lake City, UT. March 28, 2013.

Ziska, L.H., J.B. Reeves III, and B. Blank. 2005. The impact of recent increases in atmospheric CO2 on biomass production and vegetative retention of cheatgrass (*Bromus tectorum*): implications for fire disturbance. Global Change Biology 11:1325–1332.

Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  06/02/2016
Date

Concur:  11/14/2016
Date

Did not concur: _____ _____

Date

Director's Remarks: